	Type	L #	Hits	Search Text	DBs	Time Stamp
1	IS&R	L1	1	("6011536").PN.	USPAT	2002/05/01 08:42
2	BRS	L2	1	1 and long	USPAT	2002/05/01 08:56
3	BRS	L3	218	silverbrook,$.in.	USPAT	2002/05/01 08:51
4	BRS	L4	16	3 and brush	USPAT	2002/05/01 08:51
5	BRS	L6	394	silverbrook,$.in.	EPO; JPO; DERWENT; IBM_TDB	2002/05/01 08:52
6	BRS	L7	0	6 and brush	EPO; JPO; DERWENT; IBM_TDB	2002/05/01 08:52
7	BRS	L8	29372	345/$.ccls.	USPAT	2002/05/01 08:56
8	BRS	L9	10	8 and brushstroke	USPAT	2002/05/01 09:08
9	BRS	L10	56	8 and brush adj stroke	USPAT	2002/05/01 09:08
10	BRS	L11	17022	382/$.ccls.	USPAT	2002/05/01 09:08
11	BRS	L12	15	11 and brush adj stroke	USPAT	2002/05/01 09:11
12	BRS	L14	3	11 and brushstroke	USPAT	2002/05/01 09:09
13	BRS	L15	17	12 or 14	USPAT	2002/05/01 09:09
14	BRS	L16	86	brush adj stroke or brushstroke	EPO; JPO; DERWENT; IBM_TDB	2002/05/01 09:12

09/112,777

DOCUMENT-IDENTIFIER: US 6011536 A
TITLE: Method and system for generating an image having a hand-painted
appearance

---------- KWIC ---------

DWKU:
6011536

ABPL:
A method and system receives a digital source image and brush size data. The
source image is blurred to generate a digital reference image. The brush size
data includes a first record corresponding to a first size of a brush and a
second record corresponding to a second size of the brush. The first size is
different from the second size. The method and system applies brush strokes,
with the first record to be used for the brush, to a digital canvas image using
the reference image. Then the brush strokes are applied, with the second
record to be used for the brush, to the canvas image using the reference and
working images. Thus, a final digital image having a hand-painted appearance
is generated on the canvas image. Long curved brush strokes can also be used
to generate the target image, which is aligned in a normal direction to image
gradients. Furthermore the graphic artist may adjust parameters of the method
and system according to the present invention to vary the style of painting.

BSPR:
In another exemplary embodiment of the present invention, long curved brush
strokes can be used to generate the target image, which is aligned in a normal
direction to image gradients.

DRPR:
FIG. 6 shows a flowchart of an exemplary embodiment according to the present invention for generating a digital image using long curved brush strokes.

DRPR:
FIG. 7(a) shows an initial exemplary step in a procedure for applying long curved brush strokes on a canvas image.

DRPR:
FIG. 7(b) shows a second exemplary step in the procedure for applying long curved brush strokes on a canvas image.

DRPR:
FIG. 7(c) shows a third exemplary step in the procedure for applying long curved brush strokes on a canvas image.

DEPR:
FIG. 5 shows an exemplary embodiment of a method according to the present invention for painting the canvas image with the working brush (i.e., detailing step 160 described above). In particular, the processor 50 cooperates the canvas image (e.g., overlays) with a grid (step 200). In step 210, if the working brush is the largest brush selected from a list of usable brush sizes (i.e., entering first pass over the canvas image), the processor performs steps 220-250. In step 220, a first grid location on the canvas image is determined (the next grid location is determined if the first grid location was previously determined). Then, in step 230, the processor 50 determines if the current grid location is equal to the last grid location. If so, the processor 50 returns the execution to step 170 as illustrated in FIG. 3. If not, the processor 50 executes commands to make a stroke which is normal to the gradient of the current grid location on the canvas image (step 250) (e.g., to draw a

long, curved brush stroke) and the processor 50 returns the execution to step
220 where the next working grid location on the canvas image is determined and
steps 230-250 are executed again.

DEPR:
Creating Long Curved Brush Strokes

DEPR:
Individual brush strokes in a painting can convey shape, texture, overlap, and
a variety of other image features. In the exemplary embodiment according to
the present invention, step 320 (FIG. 5) can be implemented to draw a long,
curved brush stroke to generate, for example, a gesture, a curve of an object
or a play of light on a surface may be illustrated. The method and system
according to the present invention enable a use of long curved brush strokes
for painting long and continuous curves. In particular, these strokes of
constant thickness are painted (i.e., generated) to approximate the colors of
the reference image. The long curved brush strokes are provided as
anti-aliased cubic B-splines, and each may include a predetermined color and
opacity. Each stroke is rendered by dragging a circular brush mask along the
sweep of the spline. In an exemplary embodiment of the present invention, the
long curved brush strokes have a constant color and use image gradients to
guide a placement of a stroke placement in a direction normal to the gradient
of a particular image location. When the color of the stroke deviates from the
color under the grid point of the reference image by more than a values of the
current painting, the stroke ends at that control point. One can think of this
as placing splines to roughly match the isocontours of the reference image.

DEPR:

A flowchart of an exemplary embodiment according to the present invention to make long curved strokes is illustrated in FIG. 6. The long curved stroke placement algorithm begins at a given point in the image (x.sub.0,y.sub.0), with a provided brush radius R. The control point (x.sub.0,y.sub.0) is added to the spline, and the color of the reference image at (x.sub.0,y.sub.0) is used as the color of the brush stroke. Additional control points are added by following the normals of the image gradient (as described below). The processor 50 then approximates the control points with a curved brush stroke. The brush stroke may be rendered with a cubic B-spline, with an anti-aliased circular mask drawn along the path of the curve, or using another conventional method.

DEPR:
In particular, in step 400, the processor 50 determines if the stroke length is greater than the maximum stroke length. If so, the process is returned to step 270 (shown in FIG. 5). If not, the processor 50 stops the stroke if the color of the stroke differs from the color under the last control point more than the reference image differs from the canvas image at that point. The processor 50, using steps 410-440, determines if the long curved stroke should be stopped. In particular, the processor 50 determines if the stroke length is greater than the minimum stroke length in step 410. (The minimum stroke length prevents the speckled appearance of very short strokes). If so, the processor 50 determines (in step 440) if the difference between the reference blurred image and the color of the stroke (step 420) is greater than the difference between the reference blurred image and the canvas image at the current grid location (step 430). If not, the process jumps to step 460, discussed

below.

DEPR:
The remaining control points for the grid locations are computed by repeating
the process according to the present invention (as shown in FIG. 6) by moving
along the canvas image normal to the gradients and by placing control points.
As provided in steps 400-450, the long curved stroke is terminated when (a) the
predetermined maximum stroke length is reached, or (b) the color of the stroke
differs from the color under the current grid location of the blurred reference
image more than the color of the current grid point of the canvas image differs
from the corresponding grid location of the blurred reference image, and that a
minimum stroke length is reached. Thus, as shown in FIG. 7(b), the processor
50 computes a gradient direction .theta..sub.i at grid location (x.sub.i,
y.sub.i). Since there may be two normal directions, i.e., .theta..sub.i
+.pi./2, and .theta..sub.i -.pi./2., the next direction chosen minimizes the
stroke curvature. Direction D.sub.i is selected so that the angle between
D.sub.i and D.sub.i-1 is less than or equal to .pi./2. (See FIG. 7(b)). FIG.
7(c) illustrates further extensions of the long curved brush strokes.

DEPR:
Minimum/Maximum Stroke Lengths (minLength, maxLength): This parameter can be
used to restrict the possible stroke lengths. Very short strokes may be used
in a "pointillist" image, while long strokes may be used in a more
"expressionistic" image.

URNM:
Long et al.

URNM:
Long